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Eating disorders and substance use An examination of behavioral associations

Colleen Corte*, Karen Farchaus Stein

The University of Michigan, Room 2351, 400 N. Ingalls, Ann Arbor, MI 48109-0482, USA

Abstract

The association between the eating disorders of anorexia nervosa (AN) and bulimia nervosa (BN) and substance use disorder (SUD) has been widely investigated, however, our understanding of the relationship between the disorders remains unclear. Explanatory models have tended to focus on behaviors, yet, little is currently known about the patterns of association among disordered eating and substance use behaviors. In this exploratory study, a behavioral approach was used to investigate the cooccurrence of seven disordered eating and three substance use behaviors in women meeting current DSM-III-R criteria for AN ($n=12$), subthreshold AN ($n=14$), BN ($n=29$), and subthreshold BN ($n=24$). Results suggest that disordered eating behaviors are differentially associated with substance use behaviors. The most robust finding was that diuretic use positively predicted the current level of alcohol use regardless of diagnostic group. The findings for marijuana and tobacco use were less consistent. Results suggest that rather than being pervasive in all eating disordered women, higher levels of alcohol use may be found in those women who use diuretics. © 2001 Elsevier Science Ltd. All rights reserved.

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1. Introduction

The eating disorders of anorexia nervosa (AN) and bulimia nervosa (BN) are widely believed to be systematically associated with substance use disorder (SUD). The SUD diagnosis includes substance abuse which is a maladaptive pattern of use and substance

* Corresponding author. Tel.: +1-734-763-9717; fax: +1-734-936-5525.

E-mail address: corte@umich.edu (C. Corte).

dependence, which indicates impaired control over use (American Psychiatric Association (APA), 1994). A considerable amount of research effort has been devoted to clarifying the nature of the relationship between the eating disorders and SUD in an effort to develop more effective prevention and treatment strategies (see Goldbloom, 1993; Holderness, Brooks-Gunn, & Warren, 1994; Krahn, 1991 for reviews). Despite this ongoing effort, however, the nature of the relationship between the disorders remains unclear.

Research on the association between the eating disorders and SUD has been primarily in the form of comorbidity studies. Generally, comorbidity studies focus on cases in which individuals simultaneously meet diagnostic criteria for two disorders. The primary purpose of comorbidity studies is to answer important questions about etiology and course of illness, however, methodologic limitations associated with this type of study often result in inconsistent findings (Belfer, 1993; Caron & Rutter, 1991; Miller, 1994; Wittchen, 1996). Studies that have focused on the comorbidity of eating disorders and SUD are no exception. Because many studies fail to use a standardized diagnostic classification system, it is often difficult to discern the specific characteristics of the samples. In addition, because studies vary widely in the timing of the assessment relative to the age of onset and progression of each disorder, comparison across studies is difficult (Wonderlich & Mitchell, 1997). As a result of these methodological issues, findings from existing studies vary widely with the magnitude of comorbidity ranging from 5% to 50% (cf. Holderness et al., 1994; Krahn, 1991), complicating efforts to interpret the pattern of results.

Although the exploration of the relationship between the eating disorders and SUD has been primarily at the general level of cooccurring diagnoses, models of etiology have tended to focus on the cooccurrence of specific behaviors. That is, specific behaviors comprising the disorders are conceptualized as stemming from a single common cause. For example, some investigators argue that bingeing, purging, and abuse of substances such as alcohol or illicit drugs represent expressions of the underlying personality trait of impulsivity (Fahy & Eisler, 1993; Favaro & Santonastaso, 1995; Garfinkel, Moldofsky, & Garner, 1980; Hatsukami, Mitchell, Eckert, & Pyle, 1986; Keel, Mitchell, Miller, Davis, & Crow, 2000; Lacey, 1993; Lacey & Evans, 1986; Lacey & Mourelis, 1986; Taylor, Peveler, Hibbert, & Fairburn, 1993; Timmerman, Wells, & Chen, 1990; Toner, Garfinkel, & Garner, 1986; Weideman & Pryor, 1996a). Others argue that bingeing, purging, and alcohol and drug abuse reflect a collection of behavioral attempts to regulate affective disturbances (Brisman & Siegel, 1984; Hudson, Pope, Jonas, & Yurgelun-Todd, 1983; Hudson, Pope, Yurgelun-Todd, Jonas, & Frankenburg, 1987). Still, others suggest that eating disorder and SUD behaviors stem from a single type of perturbation in neurophysiologic systems such as altered function of the central nervous system reward pathways (Krahn, 1991; Sinha et al., 1996), alterations in endogenous opioid activity (Marrazzi & Luby, 1986), or altered serotonin function (Kaye & Wisniewski, 1996).

The purpose of this study is to extend the previous research by investigating the cooccurrence of specific disordered eating behaviors and substance use behaviors in women with AN or BN. Patterns of behavioral association among seven disordered eating behaviors including bingeing, vomiting, restricting, exercising, and laxative, diet pill, and diuretic use, and three substance use behaviors including alcohol, marijuana, and tobacco use are examined. This is important because inferences to behavior that are based simply on the cooccurrence of the eating disorder and SUD diagnoses can lead to erroneous conclusions

because of the behavioral heterogeneity within the diagnostic categories (Hunt, 1993; Walsh & Kahn, 1997). In addition, the behavioral approach enables consideration of the full continuum of level of involvement in specific behaviors, as well as exploration of the full range of disordered eating and substance use behaviors.

1.1. Behavioral heterogeneity

One advantage of the behavior-specific approach for examining the relationship between the eating disorders and SUD is that this approach can address the behavioral heterogeneity inherent in the eating disorder and SUD diagnostic categories. Even if standardized diagnostic criteria are used, the same diagnosis can involve different combinations of symptoms (Hunt, 1993; Walsh & Kahn, 1997). For example, an individual who meets DSM-IV diagnostic criteria for AN may do so through self-induced vomiting, use of other purgatives such as laxatives or diuretics, excessive exercise, extreme dietary restriction, or any combination of these behaviors. The DSM-IV diagnosis of bulimia nervosa can be met through various combinations of purging or restricting behavioral responses to recurrent bingeing. In the same way, only a subset of an extensive collection of behavioral symptoms is required for a SUD diagnosis, yet, numerous unique combinations of symptoms can result in the same diagnosis (Grant, Chou, Pickering, & Hasin, 1992). For example, any three or more of the following symptoms can result in a DSM-IV diagnosis of substance dependence: (1) tolerance; (2) withdrawal symptoms; (3) taking substance in larger amounts or over a longer period than was intended; (4) persistent desire or unsuccessful efforts to cut down or control substance use; (5) spending a great deal of time in activities necessary to obtain, use, or recover from the substance; (6) giving up important social, occupational, or recreational activities because of substance use; or (7) continuing substance use despite knowledge of persistent or recurrent physical or psychological problems as a result of substance use (APA, 1994). Similarly, the DSM-IV substance abuse diagnosis can be met by any one of four indicators of a maladaptive pattern of use. Because of the behavioral heterogeneity in these diagnoses, it is not surprising that the findings of existing studies are mixed; some have concluded that the prevalence of SUD is greater among individuals with BN compared to AN (Bulik, 1987; Schuckit et al., 1996; Suzuki, Higuchi, Yamada, Mizutani, & Kono, 1993; Wilson, 1993), while others suggest high levels of SUD among individuals with AN (Fichter & Quadflieg, 1996; Strober, Freeman, Bower, & Rigali, 1996).

1.2. Continuum of level of involvement

Another advantage of the behavior-specific approach for examining the relationship between the eating disorders and SUD is that it enables consideration of the disordered eating and substance use behaviors on a continuum of level of involvement — from normal or experimental involvement to levels of involvement that put one at risk for grave physical and psychological consequences. This is important because cutoff points along the continuum from mild to severe disordered eating or from substance use to substance abuse and dependence have been arbitrarily determined (Walsh & Kahn, 1997; Woody, Schuckit, Weinreib, & Yu, 1993). For example, there is no clear distinction between healthy and extreme restriction of fat and calories and healthy and excessive amounts of exercise.

Bingeing and purging may occur monthly, weekly, or multiple times daily. Similarly, while alcohol use is considered a normative behavior in adults, the boundary line indicating alcohol abuse or dependence is vague. Even with controlled substances, level of involvement provides important information that can distinguish experimentation from regular and high levels of use. It is therefore essential to examine the full continuum of level of involvement in disordered eating and substance use behaviors in order to observe patterns of relationship among specific behaviors.

1.3. Full range of disordered eating and substance use behaviors

A third advantage of the behavioral approach is that the full range of disordered eating and substance use behaviors can be explored. Studies to date have tended to select a priori, specific behaviors for study while common cooccurring behaviors remain unexamined. In a 10-year prospective study examining the effects of binge eating and dietary restraint among anorexics, the investigators concluded that binge eating during the acute phase of anorexia predicts an increased risk of developing SUD (Strober et al., 1996). The investigators further suggest that there may be a shared biologic mechanism in substance abusers and acutely ill anorexics who binge eat. This study raises important questions about the relationship of substance use to other compensatory behaviors that often cooccur with bingeing such as vomiting, the use of laxatives or diuretics, or excessive exercising. A comprehensive approach, which includes the entire range of disordered eating and substance use behaviors, increases the likelihood that true associations will be revealed.

In this research, we consider a broad range of disordered eating and substance use behaviors including the entire continuum of level of involvement in each behavior. Two research questions were addressed: (1) Are alcohol, marijuana, and tobacco use differentially associated with the disordered eating behaviors of bingeing, vomiting, restricting, exercising, and laxative, diet pill, and diuretic use? and (2) Do the patterns of association among disordered eating and substance use behaviors differ in women with AN or BN?

2. Method

2.1. Participants

Participants were 79 women with a clinically diagnosed eating disorder who participated in a larger study on self-cognitions in eating disorders (Stein & Nyquist, 2000). The DSM-III-R¹ diagnosis of AN focuses on attitudes and biological outcomes of disordered eating behaviors.

¹ The study was completed during the transition from the DSM-III-R (APA, 1989) to the DSM-IV (APA, 1994) and the Structured Clinical Interview (SCID) for DSM-IV (First, Spitzer, Gibbon, & Williams, 1997) was not yet available. Because there were no substantive differences in the eating disorder or alcohol use disorder diagnostic criteria between the two versions, results are reported based on DSM-IV criteria. Although the boundaries between alcohol abuse and dependence changed in the DSM-IV to reflect a broadening of the alcohol dependence diagnostic category, we reported the combined prevalence of alcohol abuse and dependence, and, therefore, reporting these results based on DSM-IV diagnostic criteria is justified.

Three distinct types of symptoms including distorted attitudes toward body weight and food, failure to maintain body weight at a level of at least 85% of ideal, and amenorrhea or the absence of a menstrual period for at least 3 consecutive months are required for the diagnosis. Of the 79 women, 26 met either full DSM-III-R criteria for AN ($n = 12$) or subthreshold level criteria for the disorder (i.e., met the attitudinal criteria and one of the other two biological criteria; $n = 14$). Criteria for the BN diagnosis are attitudinal and behavioral and include three distinct types of symptoms: bingeing or ingesting objectively large quantities of food in a short period of time, compensatory weight loss behaviors in response to the binge at a rate of at least twice weekly for a period of at least 3 months, and disordered attitudes about body weight and shape. Fifty-three women met either full DSM-III-R criteria for BN ($n = 29$) or subthreshold level criteria for the disorder (i.e., bingeing–purging cycles either did not meet the intensity or duration criteria or the bingeing criterion was not met, that is the woman engaged in purging behaviors in response to the ingestion of small to normal quantities of food; $n = 24$). The SCID for DSM-III-R (Spitzer, Williams, Gibbon, & First, 1989) was used to establish the eating disorder diagnoses. All interviews were completed by an experienced MSW who was trained in the administration of the SCID. Interrater reliability was established by having 10% of the audiotaped interviews coded independently by a clinical psychologist considered an expert in the administration of the SCID. Interrater reliability for the eating disorder diagnoses was high ($\kappa = 0.90$).

Participants were recruited from local treatment programs, private psychotherapists, and through community-based advertisements. Sample characteristics are shown in Table 1. No differences were found between groups in age, race, or level of education.

2.2. Measures

A self-administered Health Behaviors Questionnaire consisting of a collection of single items selected from established, substance-specific and eating disorder ques-

Table 1
Sample characteristics

	AN ($n = 12$)	Subthreshold AN ($n = 14$)	BN ($n = 29$)	Subthreshold BN ($n = 24$)	
Age in years M (S.D.)	21.8 (4.1)	21.7 (3.1)	23.5 (4.5)	21.6 (3.4)	F (df)
					χ^2 (df)
<i>Race</i>					3.8 (6)
White	100%	93%	86%	83%	
Asian	0%	7%	7%	13%	
Other	0%	0%	7%	4%	
<i>Level of education</i> ^a					9.2 (9)
College degree	33%	36%	50%	33%	
Some college	50%	43%	32%	42%	
HS or less	17%	21%	18%	13%	

^a Twelve percent of subthreshold BN sample ($n = 3$) have missing data on level of education.

tionnaires was used to measure three substance use behaviors and seven disordered eating behaviors.

2.2.1. Substance use

Questions derived from a questionnaire used in the Monitoring the Future project (O'Malley, Bachman, & Johnson, 1983) were used to measure current alcohol, marijuana, and tobacco use. The format for the alcohol and marijuana questions was "On how many occasions (if any) have you used [DRUG CATEGORY] in the last month" (0–40 or more visual analog scale). Tobacco use was measured using a dichotomous variable (current user vs. current nonuser) from the Fagerstrom Tolerance Questionnaire (Fagerstrom, 1978). Evidence to support the construct validity and test–retest reliability estimates (ranging from 0.84 to 0.89) have been shown (O'Malley et al., 1983).

2.2.2. Disordered eating behaviors

The disordered eating behaviors were measured with questions from Johnson's (1985) Diagnostic Survey for Eating Disorders. All questions refer to behaviors that occurred within the last month. Respondents were asked to indicate whether or not food restricting was used and the number of times vomiting was induced. Two questions were used to measure the frequency and intensity of laxative, diet pill, and diuretic use. For each behavior, the first question reflected the number of occasions of use in the last month and the second question reflected the number of pills taken each time. The number of pills per month was computed by multiplying the number of occasions per month by the number of pills per occasion. Bingeing and exercise were measured as part of our diagnostic interview in order to establish (1) that binges met DSM-III-R criteria (an objectively large amount of food consumed within a 2-h time frame and associated with a feeling of loss of control over the episode) and (2) that the purpose of exercising was for weight control and to obtain detailed information about the type, amount, and frequency of the exercise.

2.3. Procedure

All participants completed a written informed consent before participating in the study. The interviewer met individually with each participant to administer the SCID and Health Behaviors Questionnaire. Disordered eating behaviors and substance use behaviors were measured during the same interview. Subjects were paid a total of US\$115 for participation in the larger study.

3. Results

3.1. Disordered eating behaviors

We began our analyses by examining the extent of current involvement in each of the disordered eating behaviors for all four groups. Table 2 shows the prevalence of

Table 2
Prevalence and intensity^a of disordered eating behaviors in last month

Behavior	Percent engaging (%); mean (range)			
	AN (<i>n</i> = 12)	Subthreshold AN (<i>n</i> = 14)	BN (<i>n</i> = 29)	Subthreshold BN (<i>n</i> = 24)
Restricting ^b (yes/no)	91.7% –	85.7% –	86.2% –	83.3% –
Exercise (h/month)	83.3% 34.7 (9–98)	100% 14.4 (0.93–40)	86.2% 26.0 (0.67–84)	79.2% 26.1 (6–98)
Bingeing (no. of episodes/month)	8.3% 60.0 (60–60)	35.7% 9.8 (4–24)	100% 26.2 (3–150 ^c)	45.8% 8.7 (1–30)
Vomiting (no. of episodes/month)	33.3% 35.0 (4–60)	21.4% 12.0 (4–24)	72.4% 63.5 (3–750 ^c)	66.7% 9.8 (2–60)
Laxatives (no. of occasions/month ^d)	0% –	7.1% 12.0 (12–12)	17.2% 22.4 (2–30)	20.8% 25.0 (1–60)
Diet pills (no. of pills/month)	0% –	7.1% 20.0 (20–20)	10.3% 131.3 (4–360 ^c)	12.5% 48.0 (30–84)
Diuretics (no. of pills/month)	0% –	0% –5	13.8% 37.3 (1–120)	4.2% 4.0 (4–4)

^a Mean intensity includes only those participants who engage in the behavior.

^b Intensity is not reported for restricting because it is a dichotomous variable.

^c Extreme values are accurate.

^d Due to missing data considerations, the laxative variable was changed to reflect the number of occasions of laxative use in the last month rather than the number of laxatives taken in the last month.

disordered eating behaviors in the last month for threshold and subthreshold AN and BN groups; means and ranges for the intensity of involvement computed based on those who engaged in the behavior are also shown. The restrictive type behaviors, food restricting and exercising, were prevalent in all groups; between 79% and 92% of women in each group engaged in these behaviors. Women in all groups reported engaging in bingeing and vomiting although the prevalence varied across groups. The prevalence of bingeing ranged from 8% for threshold ANs to 100% for threshold BNs, and the prevalence of vomiting ranged from 21% for subthreshold ANs to 72% for threshold BNs. A much smaller percentage of the sample engaged in laxative, diet pill or diuretic use, a finding that is consistent with other studies (Bulik, Sullivan, Carter, & Joyce, 1997; Hatsukami et al., 1986). None of the women with threshold level AN engaged in these behaviors.

Group comparisons in level of involvement in disordered eating behaviors were completed using independent groups *t* tests. Because only those who engaged in the behavior were included in these analyses, the threshold and subthreshold groups were combined to form an AN group and a BN group in order to achieve sufficient sample sizes for group comparison. No differences between the AN and BN groups were found in the mean number of hours of exercise [$M=22.9$ (S.D.=23.3) vs. $M=26.0$ (S.D.=22.4), $t(66)=-0.55$, $P=ns$], mean number of binge episodes in the last month [$M=18.2$ (S.D.=21.7) vs. $M=21.3$ (S.D.=25.9), $t(43)=-0.28$, $P=ns$], and mean number of

vomiting episodes in the last month [$M=25.1$ (S.D.=24.8) vs. $M=40.3$ (S.D.=121.6), $t(42)=-0.33$, $P=ns$]. Too few women in the AN group engaged in laxative, diet pill, or diuretic use to enable group comparisons on these behaviors.

3.2. Substance use behaviors

Table 3 shows the prevalence of substance use behaviors in the last month for threshold and subthreshold AN and BN groups. For those who engaged in alcohol or marijuana use in the last month, group means and ranges of use are provided. As can be seen, most of the sample engaged in alcohol use, although the mean number of drinks in the last month among current alcohol users does not reflect heavy use. Fifteen percent of the total sample had a DSM-III-R lifetime alcohol use disorder [17% ($n=2$) of the threshold AN group, 7% ($n=1$) of the subthreshold AN group, 24% ($n=7$) of the threshold BN group, and 8% ($n=2$) of the subthreshold BN group]. Four percent of the total sample had a DSM-III-R current alcohol use disorder [0 threshold ANs, 7% ($n=1$) of the subthreshold ANs, 7% ($n=2$) of the threshold BNs, and 0 subthreshold BNs]. As can be seen in Table 3, approximately 13% of the total sample were current marijuana users. Four percent (4%) of the total sample had a DSM-III-R lifetime marijuana use disorder [0 threshold level ANs, 0 subthreshold ANs, 10% ($n=3$) of threshold level BNs, and 0 subthreshold level BNs]. Only one participant (subthreshold BN) had a current marijuana use disorder. Finally, tobacco use occurred in all groups.

Next, group comparisons were completed for alcohol, marijuana, and tobacco use. Again, the subthreshold and threshold level groups were combined for these analyses. An independent groups t test showed that there was no difference between the AN and BN groups in the number of occasions of alcohol use in the last month [$M=5.6$ (S.D.=4.6) vs. $M=6.1$ (S.D.=5.7), $t(53)=-0.34$, $P=ns$]. Too few women currently engaged in marijuana use to enable group comparisons on the level of use, however, a chi-square showed that there was no difference between the AN and BN groups in the prevalence of use, $\chi^2(1, N=74)=1.4$, $P=ns$. There was a difference in the prevalence of tobacco use between groups, however, with more BNs than ANs being current tobacco users, $\chi^2(1, N=76)=6.0$, $P=.01$.

Table 3
Prevalence and intensity^a of substance use behaviors in last month

Behavior	Percent engaging (%); mean (range)			
	AN ($n=12$)	Subthreshold AN ($n=14$)	BN ($n=29$)	Subthreshold BN ($n=24$)
Alcohol (no. of occasions/month)	50; 4.8 (1–10)	100; 5.9 (1–15)	62.1; 6.8 (1–25)	70.8; 5.3 (1–20)
Marijuana (no. of occasions/month)	0; – (–)	14.3; 1.0 (1)	3.4; 1.0 (1)	33.3; 2.6 (1–10)
Tobacco (yes/no) ^b	8.3; – (–)	28.6; – (–)	37.9; – (–)	54.2; – (–)

^a Mean intensity includes only those participants who engage in the behavior.

^b Intensity is not reported for tobacco because it is a dichotomous variable.

3.3. Associations among disordered eating and substance use behaviors

Exploratory hierarchical cluster analyses were completed to identify patterns of association among the disordered eating and substance use behaviors. In order to establish clinically meaningful clusters, the subthreshold and threshold level groups were combined and separate analyses were completed for the AN and BN groups. All variables were transformed to z scores in order to ensure equal weighting across variables with different scale values. We used an SPSS hierarchical agglomerative clustering method employing single linkage and a matrix of Pearson correlation coefficients to cluster analyze the data. Single linkage, a widely used method of clustering (Aldenderfer & Blashfield, 1984), constructs clusters on the basis of the highest level of similarity between variables. More specifically, at each step, a variable is joined with an existing cluster if it is highly correlated with at least one variable in the group. Cluster solutions were determined based on the number of clusters that formed prior to the fusion coefficient dropping below 0.30.

The pattern of results from the BN and AN groups analyses suggests that only the pharmacologic methods of weight control, including laxatives, diet pills, and diuretics are associated with substance use. For the BN groups, the ten variables merged into six clusters. At the first stage, marijuana and alcohol formed a cluster (fusion coefficient = 0.49). At the next stage, diuretics joined the existing cluster (fusion coefficient = 0.43). Next, tobacco joined the existing cluster with marijuana, alcohol, and diuretics (fusion coefficient = 0.43). At the last stage, bingeing and vomiting formed a separate cluster (fusion coefficient = 0.34). The remaining variables including restricting, exercise, laxatives, and diet pills failed to cluster prior to the fusion coefficient dropping below 0.30. For the AN groups, the 10 variables merged into seven clusters. At the first stage, diet pills clustered with marijuana use (fusion coefficient = 0.69). At the next stage, laxatives clustered with tobacco use (fusion coefficient = 0.40). The remaining variables — restricting, exercise, bingeing, vomiting, diuretics, and alcohol failed to cluster prior to the fusion coefficient dropping below 0.30.

To validate the results of the cluster analyses, a series of multiple regression analyses were completed. Three models that reflect the results of the cluster analyses were tested. For the first model, four predictors, including diagnostic group coded as a dummy variable, and the three pharmacologic weight control behaviors, laxatives, diet pills, and diuretics, were used to predict the number of occasions of alcohol use in the last month. For the second model, three predictors: group and the two restrictive behaviors (restricting coded as a dummy variable and exercise) were used. For the third model, there were three predictors: group, and bingeing and vomiting. In addition to main effects, all models were also tested with Group \times Behavior interaction terms.

Results of the regression analyses predicting the number of occasions of alcohol use in the last month are shown in Table 4. The first model, with pharmacologic weight control behaviors as predictors was significant, accounting for 13% of the variance in the number of occasions of alcohol use in the last month. The only significant predictor was diuretic use ($\beta = 0.35$, $P = .003$). The second model, with restrictive behaviors as predictors was not significant. In the binge/vomiting model, there was a significant Group \times Vomiting interaction. To clarify the interaction we ran the regression analyses separately for the AN and BN groups. Both models were nonsignificant. However, for the ANs, vomiting was negatively,

Table 4

Results of linear regression analyses for disordered eating behaviors as predictors of the number of occasions of alcohol use in the last month for all groups combined

Predictors	R^2	β
Model 1 — Pharmacologic behaviors ($N=72$)	.13 *	
Diagnostic group		− 0.08
No. of laxative occasions/month		0.06
No. of diet pills/month		0.02
No. of diuretics/month		0.35 **
Model 2 — Restrictive behaviors ($N=71$)	.00	
Diagnostic group		− 0.03
Restricting yes/no		− 0.01
No. of hours of exercise/month		− 0.05
Model 3 — Bingeing/vomiting behaviors ($N=71$)	.17 *	
Diagnostic group		0.20
No. of binges/month		0.37
No. of vomiting episodes/month		− 1.44 **
Diagnostic group \times Vomiting		1.24 **

N =retained sample after pairwise deletion of missing data.

* $P < .05$.

** $P < .01$.

though not significantly, related to the level of alcohol use ($\beta = -0.20$, $P = \text{ns}$), and for the BNs, vomiting was slightly positively, though not significantly related to the level of alcohol use ($\beta = 0.08$, $P = \text{ns}$).

The same three predictive models were used to predict marijuana and tobacco use. Despite the small sample size, logistic regression was used to predict these dependent variables because the tobacco variable was dichotomous and the marijuana variable was dichotomized because of a markedly skewed distribution. Again, we checked for interaction effects and none were found. For marijuana use, the binge/vomiting model was significant $\chi^2(3, N=71) = 13.8$, $P = .003$, with diagnostic group (odds ratio = 7.77, $P = .02$) and bingeing (odds ratio = 0.84, $P = .02$) being significant predictors. Specifically, for bulimics, the odds of being a marijuana user were greatly increased. However, controlling for the effects of diagnostic group, with each additional binge episode, the odds of being a marijuana user were reduced. For tobacco use, two models were significant: (1) the pharmacologic behaviors model $\chi^2(4, N=74) = 12.6$, $P = .01$, with diagnostic group being a significant predictor (odds ratio = 3.9, $P = .02$) and (2) the restrictive behaviors model $\chi^2(3, N=73) = 17.9$, $P < .001$, with diagnostic group being a significant predictor (odds ratio = 4.7, $P = .01$) and exercise being a significant predictor (odds ratio = 0.95, $P = .01$). More specifically, for bulimics, the odds of smoking cigarettes were increased. Regardless of diagnostic group, however, as the amount of exercise increased, the odds of being a cigarette smoker decreased.

As a supplementary examination of this data, we repeated all of the analyses on the subset of participants who were binge/purgers. This subsample was comprised of 50 women — 27% of the ANs were included in the subsample [threshold level AN ($n=4$), subthreshold AN ($n=3$)] and 83% of the BNs were included in the subsample [threshold level BNs ($n=24$),

subthreshold BNs ($n = 19$)]. The results of the hierarchical cluster analysis were the same as the results of the initial cluster analysis with the BN groups — diuretics clustered with alcohol, marijuana, and tobacco use. The same regression models were used to predict current alcohol, marijuana, and tobacco use with the exception of the dummy variable for the diagnostic group that was deleted. The results were similar to the results of the previous regression analyses with the entire sample. Only the pharmacologic behaviors model with laxatives, diuretics, and diet pills as predictors was significant for predicting the number of occasions of alcohol use in the last month ($R^2 = .17$, $P = .05$), and the only significant predictor was diuretics ($\beta = 0.41$, $P = .006$). The results of the logistic regression analyses to predict marijuana use showed that the binge/vomiting model was significant $\chi^2(2, N = 45) = 8.4$, $P = .02$) with bingeing being a marginally significant predictor (odds ratio = 0.87, $P = .06$); with each binge episode, the odds of being a marijuana user were decreased. The logistic regression analyses for tobacco use showed that the restrictive behaviors model was significant $\chi^2(2, N = 46) = 11.9$, $P = .003$) with exercise being a significant predictor (odds ratio = 0.94, $P = .02$); as the amount of exercise increased, the odds of being a cigarette smoker decreased.

4. Discussion

A behavior-specific approach was used to examine patterns of association among disordered eating and substance use behaviors in women with threshold and subthreshold levels of anorexia or bulimia nervosa. As expected, this approach revealed considerable heterogeneity among the disordered eating behaviors across the threshold and subthreshold AN and BN groups, with bingeing, vomiting, exercising, and food restricting occurring in all groups. In addition, results suggest that across groups, there are very specific relationships among disordered eating and substance use behaviors. That is, each substance use behavior is associated with distinctly different patterns of disordered eating behaviors. Alcohol use was associated with the use of pharmacologic weight control behaviors, particularly diuretics, regardless of diagnostic group. In contrast, diagnostic group was the strongest predictor of marijuana and tobacco use; both were more prevalent among women with threshold or subthreshold BN. However, controlling for the effects of diagnostic group, specific behavioral relationships existed. Bingeing tended to discourage marijuana use whereas exercising tended to discourage tobacco use.

As anticipated, we found that there was considerable overlap among the disordered eating behaviors across the AN and BN diagnostic categories. This behavioral heterogeneity is consistent with the DSM-IV subtyping of AN and BN into purging and nonpurging types and supports the view that the exploration of the relationship between eating disorders and SUD needs to be at the level of specific behaviors. For example, although nearly 90% of the women with threshold or subthreshold AN engaged in exercising and food restricting, approximately one-quarter of these women also engaged in bingeing and vomiting behaviors. Similarly, most of the women with threshold or subthreshold BN engaged in bingeing and vomiting, yet, over 80% of these women also engaged in exercising and food restricting.

The level of involvement in disordered eating behaviors found in this sample of women with threshold and subthreshold levels of AN and BN was similar to that found in other studies (Bulik et al., 1997; Favaro & Santonastaso, 1995; Hatsukami et al., 1986; Mitchell, Hatsukami, Eckert, & Pyle, 1985). Consistent with the finding of Bulik et al. (1997) and Hatsukami et al. (1986), pharmacologic weight control behaviors — including laxatives, diuretics, and diet pills — were less prevalent than other disordered eating behaviors. However, our data showed that pharmacologic weight control behaviors were more prevalent among women with BN compared to AN, which is the opposite of that found in a study by Favaro and Santonastaso (1995). Among those who used pharmacologic weight control behaviors, the intensity of use varied widely. In addition, the intensity of involvement in the other disordered eating behaviors — bingeing, vomiting, and exercising — tended to vary more widely within groups than between groups.

Alcohol use was prevalent in all groups, but, overall, the clinically diagnosed eating disordered women in our sample were not currently heavy alcohol users. The frequency of alcohol use ranged between one and two occasions per week for all groups. Although the reported frequency of alcohol use in our sample is low, the rate was similar to that found in BN samples (Hatsukami et al., 1986; Welch & Fairburn, 1996). In addition, it is consistent with the finding of Welch and Fairburn (1996) who found no differences in the current frequency of alcohol use between BNs and normal controls.

The prevalence of lifetime and current DSM-III-R alcohol use disorders found in our sample is somewhat difficult to compare with the findings of other studies because of methodologic differences across studies. First, investigators have tended to combine the lifetime and current prevalence rates. An exception is a recent study by Brewerton et al. (1995) who found that 20% of women with a DSM-III-R diagnosis of BN had a lifetime history of any DSM-III-R SUD, including alcohol use disorders, which is consistent with the 15% lifetime prevalence rate found in our sample. However, our rate is considerably lower than that reported in studies by Bulik et al. who found high lifetime prevalence rates of 71% (Bulik, 1987) and 52% (Bulik et al., 1997) for DSM alcohol use disorders in BN samples. One possible explanation for this large discrepancy may be that the women in Bulik's studies were older than the women in our sample ($M=30$, Bulik, 1987; $M=26$, Bulik et al., 1997; $M=22$ for our sample), thus, increasing the likelihood that alcohol use disorders would become manifest (Hanna & Grant, 1997). Second, a variety of measures have been used to establish the alcohol use disorder diagnosis. Studies using less stringent criteria found lifetime prevalence rates as high as 23–40% (Berry, Lacey, & Merry, 1986; Lacey, 1993; Mitchell et al., 1985).

The prevalence of marijuana and tobacco use in our sample was consistent with the findings of other studies. Eight percent of the ANs and 18% of the BNs were current marijuana users. A recent study by Welch and Fairburn (1996) found that 19% of BNs were current marijuana users. In addition, Weideman and Pryor (1996a, 1996b) found that more BNs than ANs had used marijuana. While none of the women in the AN groups had ever met DSM-III-R criteria for a cannabis use disorder, 6% of those in the BN groups (combined) had a lifetime diagnosis, and 2% currently met diagnostic criteria for cannabis use disorder. In addition, 19% of the ANs and 48% of the BNs were current tobacco users, which is consistent

with the findings of other recent studies with BN samples (Bulik et al., 1997) and adolescents with AN and BN (Weideman & Pryor, 1996a).

For alcohol use, both the cluster analyses and regression analyses converged to suggest that diuretic use is positively related to the current level of alcohol use regardless of diagnostic group. The fact that diagnostic group did not predict the level of alcohol use is particularly interesting given the widely held belief that alcohol use disorders are associated with bulimia nervosa (cf. Holderness et al., 1994). Our results suggest a much narrower and more specific pattern of association between alcohol use and disordered eating behaviors.

Although our results are inconsistent with the prevailing view that substance abuse is broadly associated with bulimia nervosa, and is instead related to behaviors, other studies have had similar findings. Almost a decade ago, Mitchell, Pyle, Specker, and Hanson (1992) argued that laxatives, diuretics, and diet pills are “atypical substances of abuse.” These researchers suggested that women with eating disorders may “abuse” these medications in much the same way as alcohol and other drugs. Therefore, one particular type of weight control behavior, pharmacologic weight control behaviors, may represent a pernicious pattern of ingestive behaviors. Similarly, a study by Bulik et al. (1997) found that women with BN and a lifetime history of alcohol dependence were more likely to be current laxative users. Hatsukami et al. (1986) suggest that use of these “atypical substances of abuse,” as well as alcohol and illicit drug use may stem from high levels of underlying impulsivity, however, this theoretical idea has not been empirically tested.

Unlike alcohol, marijuana use was associated with the BN diagnostic group. This finding is consistent with the existing literature that suggests that marijuana use is more common among individuals with BN compared to AN (Weideman & Pryor, 1996b). Although our data showed that diagnostic group was the best predictor of marijuana use in eating disordered women, when the effects of diagnostic group were held constant, bingeing tended to reduce the odds of marijuana use. Although this finding may be counterintuitive, there is little empirical evidence of a specific relationship between bingeing and marijuana use. Furthermore, a recent study that specifically examined bingeing and marijuana use in a sample of eating disordered women found no relationship between bingeing and marijuana use (Weideman & Pryor, 1996b).

Tobacco use was also associated with the BN diagnostic group. Other studies have similarly shown that tobacco use was more prevalent among individuals with BN compared to those with AN (Weideman & Pryor, 1996a; Wiseman, Turco, Sunday, & Halmi, 1998). Again, although the BN diagnostic group was the strongest predictor of tobacco use in eating disordered women, controlling for diagnostic group, exercising tended to reduce the odds of tobacco use. This finding is consistent with the results of a recent study with a normal sample (Costakis, Dunnagan, Haynes, & Bozeman, 1999), but is not consistent with the findings of recent study of eating disordered women that showed that the severity of purging behaviors predicted tobacco use (Weideman & Pryor, 1996b). Further studies are needed to explicate the relationship between disordered eating behaviors and tobacco use.

Taken together, the findings from this study partially refute the widely held view that bulimia nervosa — and more specifically bingeing and purging — are associated with

substance use. Our results suggest that disordered eating behaviors are differentially associated with substance use. Alcohol was related to diuretic use regardless of diagnostic group, but was not associated with bingeing or with other forms of purging, i.e., vomiting and laxative use. Consistent with the existing literature, marijuana and tobacco use were more generally associated with the diagnostic category of bulimia nervosa. However, specific behavioral relationships also existed for these substances after controlling for the effects of diagnostic group. While bingeing reduced the odds of marijuana use, none of the purging behaviors were associated with marijuana use. Exercising tended to discourage tobacco use, but neither bingeing nor any of the purging behaviors were associated with tobacco use. Thus, these data suggest that even when diagnostic group is predictive, each particular substance is uniquely linked to disordered eating behaviors.

The findings from this study illustrate the advantage of examining the entire continuum of level of involvement in a wide range of disordered eating and substance use behaviors. The different patterns of association among the various disordered eating and substance use behaviors revealed in this study would have been missed by looking only at the cooccurrence of the eating disorder and SUD diagnoses. These data further suggest that studies designed to explore the nature of the associations between these complex disorders need to consider each substance separately. The association between diuretics and alcohol use may point to maladaptive attempts to regulate affect through the ingestion of substances. Alternatively, both alcohol and diuretic use may reflect high levels of impulsivity, although bingeing and vomiting, which are thought to be impulsive behaviors (Bulik et al., 1997; Hatsukami et al., 1986; Lacey, 1993; Weideman & Pryor, 1996a), did not appear to be related to alcohol use. In contrast, marijuana and tobacco use do not appear to be related to ingestion of substances. The fact that these substance use behaviors are most strongly associated with the BN diagnostic group also raises questions about possible perturbations in neurotransmitter systems common to bulimia and marijuana and tobacco use.

The present study has some limitations that may have an impact on the validity of the conclusions. First, while the alcohol measure provided information about frequency of use, it did not provide information about the amount consumed at each occasion. Because we assumed a minimum number of drinks consumed at each occasion, we are most likely underestimating the actual intensity of alcohol consumption in our sample. Thus, the strength of the association between alcohol use and diuretics found in this study may in fact be a conservative estimate. It is not likely, however, that this measure would have negatively influenced our ability to detect associations between alcohol and bingeing and other forms of purging, i.e., vomiting and laxative use, because many more women were engaging in these behaviors compared to diuretics where an association was detected. Second, the sample size was relatively small. Therefore, attempts to replicate these findings with other samples are encouraged. Third, causal implications are not possible because of the cross-sectional nature of the study.

Despite the limitations, this work represents an important step in exploring the patterns of association among disordered eating and substance use behaviors. In this study, we examined the entire continuum of level of involvement in a wide range of disordered eating and substance use behaviors in an effort to see how specific behaviors come together, and ultimately, so that underlying mechanisms can be identified. Results suggest

that within diverse populations of eating disordered women, alcohol use may be linked to a specific type of weight control behavior. Rather than being pervasive in all eating disordered women, higher levels of alcohol use may be found in those women who use diuretics. In summary, diuretic use may be part of an organized constellation of ingestive behaviors that should be considered in the assessment and treatment of women with eating disorders.

References

- Aldenderfer, M. S., & Blashfield, R. K. (1984). A review of clustering methods. In: M. S. Lewis-Beck (Ed.), *Cluster analysis: Quantitative applications in the social sciences: series/number 07-044* (pp. 33–62). Newbury Park, CA: Sage Publications.
- American Psychiatric Association. (1989). *Diagnostic and statistical manual for mental disorders* (3rd ed., Revised). Washington, DC: American Psychological Association.
- American Psychiatric Association. (1994). *Diagnostic and statistical manual for mental disorders* (4th ed.). Washington, DC: American Psychological Association.
- Belfer, M. L. (1993). Substance abuse with psychiatric illness in children and adolescents: definitions and terminology. *American Journal of Orthopsychiatry, 63*, 70–79.
- Berry, M. D., Lacey, J. H., & Merry, J. (1986). Alcoholism and eating disorders in women of fertile age. *British Journal of Addiction, 81*, 685–689.
- Brewerton, T. D., Lydiard, B., Herzog, D. B., Brotman, A. W., O'Neil, P. M., & Ballenger, J. C. (1995). Comorbidity of Axis I psychiatric disorders in bulimia nervosa. *Journal of Clinical Psychiatry, 56*, 77–80.
- Brisman, J., & Siegel, M. (1984). Bulimia and alcoholism: two sides of the same coin? *Journal of Substance Abuse Treatment, 1*, 113–118.
- Bulik, C. M. (1987). Drug and alcohol abuse by bulimic women and their families. *American Journal of Psychiatry, 144*, 1604–1606.
- Bulik, C. M., Sullivan, P. F., Carter, F. A., & Joyce, P. R. (1997). Lifetime comorbidity of alcohol dependence in women with bulimia nervosa. *Addictive Behaviors, 22*, 437–446.
- Caron, C., & Rutter, M. (1991). Comorbidity in child psychopathology: concepts, issues and research strategies. *Journal of Child Psychology and Psychiatry, 32*, 1063–1080.
- Costakis, C. E., Dunnagan, T., Haynes, G., & Bozeman, M. T. (1999). The relationship between the stages of exercise adoption and other health behaviors. *American Journal of Health Promotion, 14*, 22–30.
- Fagerstrom, K. O. (1978). Measuring degree of physical dependence to tobacco smoking with reference to individualization to treatment. *Addictive Behaviors, 3*, 235–241.
- Fahy, T., & Eisler, I. (1993). Impulsivity and eating disorders. *British Journal of Psychiatry, 162*, 193–197.
- Favaro, A., & Santonastaso, P. (1995). Purging behaviors, suicide attempts, and psychiatric symptoms in 398 eating disordered subjects. *International Journal of Eating Disorders, 20*, 99–103.
- Fichter, M. M., & Quadflieg, N. (1996). Course and two-year outcome in anorexic and bulimic adolescents. *Journal of Youth and Adolescence, 25*, 545–562.
- First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. (1997). *Structured clinical interview for DSM-IV Axis I disorders*. New York, NY: Biometrics Research Department.
- Garfinkel, P. E., Moldofsky, H., & Garner, D. M. (1980). The heterogeneity of anorexia nervosa. *Archives of General Psychiatry, 37*, 1036–1040.
- Goldbloom, D. S. (1993). Alcohol misuse and eating disorders: aspects of an association. *Alcohol and Alcoholism, 28*, 375–381.
- Grant, B. F., Chou, S. P., Pickering, R. P., & Hasin, D. S. (1992). Empirical subtypes of DSM-III-R alcohol dependence: United States, 1988. *Drug and Alcohol Dependence, 30*, 75–84.
- Hanna, E. Z., & Grant, B. F. (1997). Gender differences in DSM-IV alcohol use disorders and major depression as distributed in the general population: clinical implications. *Comprehensive Psychiatry, 38*, 202–212.

- Hatsukami, D., Mitchell, J. E., Eckert, E. D., & Pyle, R. (1986). Characteristics of patients with bulimia only, bulimia with affective disorder, and bulimia with substance abuse problems. *Addictive Behaviors, 11*, 399–406.
- Holderness, C. C., Brooks-Gunn, J., & Warren, M. P. (1994). Co-morbidity of eating disorders and substance abuse: review of the literature. *International Journal of Eating Disorders, 16*, 1–34.
- Hudson, J. I., Pope, H. G., Jonas, J. M., & Yurgelun-Todd, D. (1983). Phenomenological relationship of eating disorders to major affective disorder. *Psychiatry Research, 9*, 345–354.
- Hudson, J. I., Pope, H. G., Yurgelun-Todd, D., Jonas, J. M., & Frankenburg, F. R. (1987). A controlled study of lifetime prevalence of affective and other psychiatric disorders in bulimic outpatients. *American Journal of Psychiatry, 144*, 1283–1287.
- Hunt, W. A. (1993). Neuroscience research: how has it contributed to our understanding of alcohol abuse and alcoholism? A review. *Alcoholism: Clinical and Experimental Research, 17*, 1055–1065.
- Johnson, C. L. (1985). Initial consultation for patients with bulimia and anorexia nervosa. In: D. M. Garner, & P. E. Garfinkel (Eds.), *Handbook of psychotherapy for anorexia and bulimia* (pp. 19–51). New York, NY: Guilford Press.
- Kaye, W. H., & Wisniewski, L. (1996). Vulnerability to substance abuse in eating disorders. *NIDA Research Monograph, 159*, (pp. 269–311). Bethesda, M.D.: National Institutes of Health, National Institute on Drug Abuse.
- Keel, P. K., Mitchell, J. E., Miller, K. B., Davis, T. L., & Crow, S. J. (2000). Predictive validity of bulimia nervosa as a diagnostic category. *American Journal of Psychiatry, 157*, 136–138.
- Krahn, D. D. (1991). The relationship of eating disorders and substance abuse. *Journal of Substance Abuse, 3*, 239–253.
- Lacey, J. H. (1993). Self-damaging and addictive behaviour in bulimia nervosa: a catchment area study. *British Journal of Psychiatry, 163*, 190–194.
- Lacey, J. H., & Evans, C. D. H. (1986). The impulsivist: a multi-impulsive personality disorder. *British Journal of Addiction, 81*, 641–649.
- Lacey, J. H., & Mourel, E. (1986). Bulimic alcoholics: some features of a clinical subgroup. *British Journal of Addiction, 81*, 389–393.
- Marrazzi, M., & Luby, E. (1986). An auto-addiction opioid model of chronic anorexia nervosa. *International Journal of Eating Disorders, 5*, 191–208.
- Miller, N. S. (1994). Psychiatric comorbidity: occurrence and treatment. *Alcohol Health and Research World, 18*, 261–264.
- Mitchell, J. E., Hatsukami, D., Eckert, E. D., & Pyle, R. L. (1985). Characteristics of 275 patients with bulimia. *American Journal of Psychiatry, 142*, 482–485.
- Mitchell, J. E., Pyle, R. L., Specker, S., & Hanson, K. (1992). Eating disorders and chemical dependency. In: J. Yager, H. E. Gwirtsman, & C. K. Edelstein (Eds.), *Special problems in managing eating disorders* (pp. 1–14). Washington, DC: American Psychiatric Press.
- O'Malley, P. M., Bachman, J. G., & Johnson, L. D. (1983). Reliability and consistency in self-reports of drug use. *The International Journal of the Addictions, 18*, 805–824.
- Schuckit, M. A., Tipp, J. E., Anthenelli, R. M., Buchholz, K. K., Hesselbrock, V. M., & Nurnberger, J. I. (1996). Anorexia nervosa and bulimia nervosa in alcohol-dependent men and women and their relatives. *American Journal of Psychiatry, 153*, 74–82.
- Sinha, R., Robinson, J., Merikangas, K., Wilson, G., Rodin, J., & O'Malley, S. (1996). Eating pathology among women with alcoholism and/or anxiety disorders. *Alcoholism: Clinical and Experimental Research, 20*, 1184–1191.
- Spitzer, R. L., Williams, J. B., Gibbon, M., & First, M. B. (1989). *Structured clinical interview for DSM-III-R — patient edition*. New York, NY: Biometrics Research Department.
- Stein, K. F., & Nyquist, L. (2000). The impoverished self: identity disturbances in the eating disorders. (unpublished manuscript).
- Strober, M., Freeman, R., Bower, S., & Rigali, J. (1996). Binge eating in anorexia nervosa predicts later onset of substance use disorder: a ten-year prospective, longitudinal follow-up of 95 adolescents. *Journal of Youth and Adolescence, 25*, 519–532.

- Suzuki, K., Higuchi, S., Yamada, K., Mizutani, Y., & Kono, H. (1993). Young female alcoholics with and without eating disorders: a comparative study in Japan. *American Journal of Psychiatry*, *150*, 1053–1058.
- Taylor, A. V., Peveler, R. C., Hibbert, G. A., & Fairburn, C. G. (1993). Eating disorders among women receiving treatment for an alcohol problem. *International Journal of Eating Disorders*, *14*, 147–151.
- Timmerman, M. G., Wells, L. A., & Chen, S. (1990). Bulimia nervosa and associated alcohol abuse among secondary school students. *Journal of the American Academy of Child and Adolescent Psychiatry*, *29*, 118–122.
- Toner, B. B., Garfinkel, P. E., & Garner, D. M. (1986). Long-term follow-up of anorexia nervosa. *Psychosomatic Medicine*, *48*, 520–529.
- Walsh, B. T., & Kahn, C. B. (1997). Diagnostic criteria for eating disorders: current concerns and future directions. *Psychopharmacology Bulletin*, *33*, 369–372.
- Weideman, M. W., & Pryor, T. (1996a). Substance use and impulsive behaviors among adolescents with eating disorders. *Addictive Behaviors*, *21*, 269–272.
- Weideman, M. W., & Pryor, T. (1996b). Substance use among women with eating disorders. *International Journal of Eating Disorders*, *20*, 163–168.
- Welch, S. L., & Fairburn, C. G. (1996). Impulsivity or comorbidity in bulimia nervosa: a controlled study of deliberate self-harm and alcohol and drug misuse in a community sample. *British Journal of Psychiatry*, *169*, 451–458.
- Wilson, G. T. (1993). Binge eating and addictive disorders. In: C. G. Fairburn, & G. T. Wilson (Eds.), *Binge eating: nature, assessment, and treatment* (pp. 97–120). New York, NY: The Guilford Press.
- Wiseman, C. V., Turco, R. M., Sunday, S. R., & Halmi, K. A. (1998). Smoking and body image in adolescent girls. *International Journal of Eating Disorders*, *24*, 429–433.
- Wittchen, H. (1996). Critical issues in the evaluation of comorbidity of psychiatric disorders. *British Journal of Psychiatry*, *168* (Suppl. 30), 9–16.
- Wonderlich, S. A., & Mitchell, J. E. (1997). Eating disorders and comorbidity: empirical, conceptual, and clinical implications. *Psychopharmacology Bulletin*, *33*, 381–390.
- Woody, G., Schuckit, M., Weinreb, R., & Yu, E. (1993). A review of the substance use disorders section of the DSM-IV. *Psychiatric Clinics of North America*, *16*, 21–32.